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Effects of the Strong Hearts program at two years post program completion

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Abstract

Context: This is a follow-up to the original published article, Effects of the Strong Hearts Program after a Major Cardiovascular Event in Patients with Cardiovascular Disease.

Objectives: This study evaluated the long-term efficacy of the Strong Hearts program up to 2 years after program completion.

Methods: All study participants who initially completed the Strong Hearts program between 2020 and 2021 (n=128) were contacted at 12 months and 24 months following the date of program completion. A phone survey was conducted to see if any significant post-cardiovascular events or readmissions to the hospital occurred, and self-reported dates of any occurrences were recorded. Hospital readmissions and cardiac-related procedures were cross-referenced with the hospital's electronic medical record. A chi-square goodness-of-fit analysis was utilized to compare the observed rates of categorical outcomes vs. expected rates yielded from the empirical literature.

Results: The rate of all-cause readmission at 6 months post-program completion was 2/120 (1.7 %), compared to the expected rate of 50 %, $\chi^2(1) = 112.13$, $p < 0.001$. The readmission rate at 1 year post-program completion was 17/120 (14.2 %), vs. the expected rate of 45 %, $\chi^2(1) = 46.09$, $p < 0.001$, and at 2 years post-program completion, the readmission rate was 24/120 (20.0 %) compared to the expected rate of 53.8 %, $\chi^2(1) = 56.43$, $p < 0.001$. Ten participants (8.3 %) had a subsequent cardiac procedure within 2 years of completing the program, including two requiring percutaneous coronary intervention (1.7 %) and eight requiring coronary artery bypass grafting

(CABG, 6.7 %), compared to the expected rates of 13.4 and 57.74 %, $\chi^2(1)=153.08$, $p < 0.001$, respectively. Mortality at 2 years post-program completion was 2/128 (1.6 %), compared to 23.4 %, $\chi^2(1)=34.13$, $p < 0.001$.

Conclusions: Efficacy of the Strong Hearts program continued at 6 months, 1 year, and 2 years post-program completion in terms of all-cause readmission, subsequent cardiac event, and all-cause mortality.

Keywords: cardiovascular; exercise; long term outcomes

Cardiac rehabilitation (CR) and intensive cardiac rehabilitation (ICR) programs have a positive impact on the progression of cardiovascular disease (CVD) in the CVD patient population. CR attendance has been shown to be associated with lower frequency of hospital admissions (odds ratio [OR] 0.53, 95 % confidence interval [CI]: 0.31–0.91, $p=0.022$) [1] and a reduction in all-cause mortality at 3 years [2] and 5 years [3] post-CR completion. In the Lifestyle Heart Trial conducted between 1986 and 1992, patients randomized into the Ornish Intensive Cardiac Rehabilitation program showed more regression of coronary atherosclerosis compared to the control group, in whom coronary atherosclerosis continued to progress and in whom more than twice as many cardiac events occurred [4]. Despite the importance of CR participation in secondary CVD prevention, CR continues to be highly underutilized.

The Strong Hearts program was designed as a secondary prevention program to help improve CVD risk factors in the CVD population. The program was designed to be an ICR program, with patients attending two 1-h sessions per day 4 days per week for 9 weeks. Initial results at the time of program completion were published in this journal in March 2023, entitled “Effects of the Strong Hearts Program after a Major Cardiovascular Event in Patients with Cardiovascular Disease.” [5] In that study, we found that the Strong Hearts program was effective in improving CVD risk factors including body composition, lipid profile, blood pressure, and depression score, increasing exercise capacity, and improving quality of life [5]. This follow-up was aimed to evaluate the extended effects of the Strong Hearts program on the progression of CVD and mortality.

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Methods

The protocol was approved by Western Institutional Review Board (WIRB ID #20192395), and written informed consent was obtained from all participants before participation. The original study design including recruitment, as well as the demographics of the study population, was described previously [5]. All patients who previously completed the Strong Hearts Program (n=128) were contacted by clinic staff via phone, and information was recorded on a Microsoft Excel spreadsheet in preparation for data analysis. Patients were asked questions about recent procedures or events related to CVD diagnosis, specifically, coronary artery bypass graft (CABG) and percutaneous coronary intervention (PCI). Other nonrelated cardiovascular procedures or events were also recorded. All communication dates were recorded for documentation and verification. Procedures and hospital readmissions were cross-referenced with the hospital's electronic medical records. Death records were searched for all patients who were not able to be reached via phone.

Statistical analysis

Frequency and descriptive statistics were utilized to describe the demographic and clinical characteristics of the sample. Chi-square goodness-of-fit analysis was utilized to compare the observed rates of categorical outcomes vs. expected rates yielded from the empirical literature. Frequency and percentage statistics were reported for the chi-square analyses. If a significant main effect was detected, unadjusted ORs with 95 % CIs were calculated. Statistical significance was assumed at a two-sided alpha value of 0.05, and all analyses were performed utilizing SPSS Version 29 [6].

Results

One hundred and twenty patients (n=120) responded to contact for follow-up. Six patients were lost to follow-up, and two patients were deceased.

We saw a significantly lower all-cause readmission rate at 6 months, 1 year, and 2 years post-program completion compared to empirical data found in the literature. At 6 months after program completion, the observed readmission rate was 1.7 % compared to the expected rate of 50 %, $\chi^2(1)=112.13$, $p<0.001$ [7]. Observed all-cause readmission at 1 year post-program completion was 14.2 % vs. the expected 45 %, $\chi^2(1)=46.09$, $p<0.001$ [8]. Observed all-cause readmission at 2 years post-program completion was 20.0 %

Table 1: A goodness-of-fit analysis for observed vs. expected rates of readmissions, subsequent cardiac event, and mortality.

Outcome	Level	Observed n	Expected n	Chi-square value	p-value
All-cause readmissions, 6 months	Yes	2 (1.7 %)	60 (50.0 %)	112.13	< 0.001
	No	118 (98.3 %)	60 (50.0 %)		
All-cause readmissions, 1 year	Yes	17 (14.2 %)	54 (45.0 %)	46.09	< 0.001
	No	103 (85.8 %)	66 (55.0 %)		
All-cause readmissions, 2 years	Yes	24 (20.0 %)	65 (54.2 %)	56.43	< 0.001
	No	96 (80.0 %)	55 (45.8 %)		
Subsequent PCI, 2 years	Yes	2 (1.7 %)	69 (57.5 %)	153.08	< 0.001
	No	118 (98.3 %)	51 (42.5 %)		
Subsequent CABG, 2 years	Yes	8 (6.7 %)	16 (13.3 %)	4.62	0.032
	No	112 (93.3 %)	104 (86.7 %)		
All-cause mortality, 2 years	Yes	2 (1.6 %)	30 (23.4 %)	34.13	< 0.001
	No	126 (98.4 %)	98 (76.6 %)		

CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention.

vs. the published rate of 53.8 %, $\chi^2(1)=56.43$, $p<0.001$ [9]. The observed subsequent PCI or the need for PCI at 2 years post-program completion was 1.7 % vs. the previously reported 57.74 %, $\chi^2(1)=153.08$, $p<0.001$ [1]. The observed subsequent CABG rates, or the need for CABG at 2 years post-ICR completion, was 6.7 % vs. the published rate of 13.4 % [1], which reflected a significantly lower rate, $\chi^2(1)=4.62$, $p=0.032$. The expected all-cause mortality rate at 2 years post-ICR completion was 23.4 % [3]. In comparison, we only saw a 1.6 % rate of all-cause mortality, which was significantly lower than expected, $\chi^2(1)=34.13$, $p<0.001$. See Table 1 for a goodness-of-fit analysis for each outcome considered.

Discussion

The previously published results of the Strong Hearts program have demonstrated significant positive outcomes in mitigating cardiac risk factors among CVD patients. Notably,

these effects have persisted beyond the program's completion, with a decreased risk of cardiovascular reoccurrences and mortality at up to 2 years post-program completion. Our findings regarding readmission rates for patients who completed CR have surpassed those documented in the existing literature, indicating the efficacy of our program approach.

Central to the success of the Strong Hearts program is its patient-centered approach to intensive lifestyle behavior modification, encompassing personalized dietary adjustments, medical exercise therapy, behavioral change, and health education. The program includes live, hands-on structured classes focused on functional medicine, nutrition, and quality of life. The program differs from existing ICR programs in the fact that less emphasis is placed on a strict one-size-fits-all diet, and more emphasis is placed on the patient's metabolic, medical, and environmental needs. Through interactive cooking demonstrations and tailored nutrition education, particularly relevant to the demographic served in the southern United States, specifically Arkansas, the program equips patients with practical tools for sustained CVD improvement.

The program's emphasis on individualized care, utilizing each patient's unique medical profile and information, ensures the development of personalized programs that are realistic and feasible for long-term results.

Limitations

The authors would like to recognize that patients did not return for an in-person visit during the 2 years after program discharge, and data were not collected about nutrition and physical activity habits during that time. We wanted to match as best we could the offerings of the program to the patient without the influence of being monitored or asked to alter behavior for fear of impact on the study results. However, the strength of the study could have been improved by bringing the patients in for lab work to analyze their lipid profile and A1c, and/or by completing a cardiac risk assessment.

Conclusions

The Strong Hearts program not only addresses immediate cardiac risk factors but also fosters longer-term health outcomes. The program has shown through this follow-up to reduce CVD reoccurrences while having improved all-cause readmissions and mortality significantly following

CR completion compared to other CR programs. The demonstrated effectiveness in reducing readmission rates and mortality underscores the role of our program in positively impacting the progression of CVD in this population. As we continue to refine and expand our efforts, the Strong Hearts program remains dedicated to the commitment to have a positive impact on patient lives and to combat the pervasive threat of CVD in our state.

Research ethics: This study was originally approved by WCG.

Informed consent: Informed consent was obtained from all individuals included in this study, or their legal guardians or wards.

Author contributions: All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Use of Large Language Models, AI and Machine Learning

Tools: None declared.

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